ACCESS MANAGEMENT WITH MULTIPATH TRANSPORT

BACKGROUND

[0001] Technical Field

[0002] The exemplary and non-limiting embodiments relate generally to radio access communication and, more particularly, to communication using multiple paths at a same time.

[0003] Brief Description of Prior Developments

[0004] The following abbreviations that may be found in the specification and/or the drawing figures are defined as follows:

[0005] 3GPP—Third Generation Partnership Project

[0006] AAA—Authentication, Authorization, Accounting

[0007] ANDSF—Access Network Discovery and Selection Function

[0008] APN—Access Point Name (e.g. Elisa Internet)

[0009] CN—Core Network

[0010] DHCP—Dynamic Host Configuration Protocol

[0011] eNB—Evolved NodeB (base station)

[0012] ePDG—enhanced/evolved Packet Data Gateway

[0013] EPC—Evolved Packed Core

[0014] IETF—Internet Engineering Task Force

[0015] IARP—Inter-APN Routing Policy

[0016] IMS—IP Multimedia subsystem; network architecture and functionality to deliver IP multimedia services.

[0017] IP—Internet Protocol

[0018] ISMP—Inter-System Mobility Policy (not applicable with MPTCP)

[0019] ISRP—Inter-System Routing Policy

[0020] MCG—Master Cell Group of dual connectivity

[0021] MME—Mobility Management Entity

[0022] MNO—Mobile Network Operator

[0023] MO—Management Object

[0024] MPTCP—Multipath TCP i.e. TCP protocol using multiple transmission paths over multiple IP addresses

[0025] NAS—Network Access Server

[0026] NAS—non-Access-Stratum (such as Connection management protocol for example)

[0027] P-GW—PDN Gateway

[0028] PDN—Public Data Network, Packet Data Network

[0029] RAN—Radio Access Network

[0030] RAT—Radio Access Technology

[0031] SCG—Secondary Cell Group of dual connectivity

[0032] SGW—gateway, a serving gateway

[0033] SSID—Service Set Identifier

[0034] TCP—Transmission Control Protocol

[0035] UE—User Equipment

[0036] WLAN—Wireless Local Area Network (a.k.a. Wi-Fi)

[0037] WLANSP—WLAN Selection Policy

[0038] WLCP—WLAN Control Protocol

[0039] MPTCP is defined by the Internet Engineering Task Force (IETF) for a generic Transmission Control Protocol (TCP) level mechanism that works over multiple Internet Protocol (IP) interfaces to improve throughput and robustness. MPTCP does not limit, nor guide, the use of radio access networks (RANs) for MPTCP purposes. The use of multiple radio access networks (RANs) simultaneously is a functionality which requires operational policies and, therefore, Third Generation Partnership Project (3GPP) has specified a management object (MO) to assist the User Equipment (UE) operation in this architecture. 3GPP has not worked on MPTCP related aspects, but has assumed that the MPTCP sessions are transparent to the 3GPP system. Conventional management objects (MOs) do not include any definitions for the MPTCP use.

SUMMARY

[0040] The following summary is merely intended to be exemplary. The summary is not intended to limit the scope of the claims.

[0041] In accordance with one aspect, an example method comprises transmitting from a node a request for a packet data network (PDN) connection; and indicating by the node that the PDN connection request is for a multipath transmission control protocol (MPTCP) use.

[0042] In accordance with another aspect, an example embodiment is provided in an apparatus comprising at least one processor; and at least one non-transitory memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to: transmit from the apparatus a request for a packet data network (PDN) connection; and indicate by the apparatus that the PDN connection request is for a multipath transmission control protocol (MPTCP) use.

[0043] In accordance with another aspect, an example embodiment is provided in a non-transitory program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine for performing operations, the operations comprising: transmitting from a node a request for a packet data network (PDN) connection; and indicating by the node that the PDN connection request is for a multipath transmission control protocol (MPTCP) use.

[0044] In accordance with another aspect, an example embodiment is provided in an apparatus comprising means for transmitting from a node a request for a packet data network (PDN) connection; and means for indicating by the node that the PDN connection request is for a multipath transmission control protocol (MPTCP) use.

[0045] In accordance with another aspect, an example method comprises receiving a request by a node for a second packet data network (PDN) connection, where the node has a first packet data network (PDN) connection; and accepting the request for the second packet data network (PDN) connection based, at least partially, upon the node indicating that the second PDN connection request is for a multipath transmission control protocol (MPTCP) use.

[0046] In accordance with another aspect, an example embodiment is provided in an apparatus comprising at least one processor; and at least one non-transitory memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to: determine if a node has a first packet data network (PDN) connection; and accept a request by the node for a second packet data network (PDN) connection based, at least partially, upon the node receipt of an indication that the second PDN connection request is for a multipath transmission control protocol (MPTCP) use.

[0047] In accordance with another aspect, an example embodiment is provided in a non-transitory program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine for performing operations, the operations comprising: determining if a